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HELPING BEHAVIOR AND GROUP SIZE: SOME EXPLORATORY STOCHASTIC MODELS[1]

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Data from previous experiments on helping behavior are reanalyzed. An exponential model in which the probability of helping behavior taking place remains constant regardless of number of bystanders appears to fit data from experiments involving noncommunicating strangers. An exponential model in which the probability of helping behavior declines as the square of the number of bystanders appears to fit data from experiments involving strangers in an emergency situation with communication possibilities. Groups of friends in an emergency situation with communication possibilities appear to coordinate behavior so as to engage in helping behavior with the same probability as single individuals. However, data points are too few to make conclusions anything other than suggestive.

A NUMBER of studies have been done of the relationship between task achievement, individual effort and group size. Results have varied depending in large part on the nature of the task. In some cases, group productivity increased with group size; in some cases it decreased and both linear and nonlinear relationships were found (Steiner, 1966; Lorge, Fox, Davitz, & Brenner, 1958). In almost all cases the extent of individual efforts decreased with group size, although in a few cases the extent of individual effort was roughly invariant with group size (Wicker, McGrath, & Armstrong, 1962; Barker & Gump, 1964; Sweeney, 1973).

Olson (1965) has shown that, under certain plausible assumptions, many group tasks will never be achieved even though the collective benefits were the task to be achieved would exceed the collective costs of achieving the task, because individual benefits from group success will be such as to motivate "free-rider" behavior. That is, individuals seek to benefit from the efforts of others without contributing, or contributing only minimally, to the group effort themselves. Olson has argued that only selective incentives for individual task performance, e.g., private benefits, coercion, can motivate cooperative behavior in free-rider conducive environment (Frohlich, Oppenheimer, & Young, 1971). Under Olson's assumptions, individual rates, probability, of participation and extent or amount of participation in a group endeavor will be higher the smaller the group, at least for groups in which members' activities, or lack thereof, are visible to the entire group.

Steiner (1966) has specified a number of simple models for the relationship between group size and group task performance, e.g., an additive model in which group performance is simply the sum of individual efforts; a conjunctive (disjunctive) model in which group performance is determined by the aptitude of its least (most) competent member(s); and a stochastic sampling model for group performance, as well as some more complex models allowing for division of labor in a dichotomous choice situation. However, in all of Steiner's models full participation by all group members is assumed.

One of the most interesting areas of research into the relationship between group performance and group size is that of helping behavior. After the Kitty Genovese murder in New York in 1964—in which 38 of the woman's neighbors came to their windows when she cried out in terror, but none came to her assistance and none called the police even though her assailant took over half an hour to murder her—a number of social

[1] The author is deeply indebted to Professor John M. Sweeney, Jr., for calling to his attention the work on helping behavior and for his insightful review of this literature (Sweeney, 1973). Without him, this paper would never have been written.

psychologists were led to investigate the determinants of bystander intervention in emergencies. The typical procedure used by these researchers involves exposing one or more persons to an event which is an emergency but is not without an element of ambiguity, e.g., detecting the presence of smoke, overhearing what appears to be a fall from a chair or ladder or a seizure victim's plea for help, etc. The main dependent variables are whether the person(s) help(s) the victim and how long it takes him (them) to do so (Darley & Latane, 1968; Latane & Darley, 1968; 1969a; 1969b; Latane & Rodin, 1969).

In this paper we shall review these studies on helping behavior in which the number of bystanders was a variable, and shall propose three probabilistic models, each of which can be made to fit quite nicely the data generated by several of these studies.

In the first of these now classic experiments (Darley & Latane, 1968) subjects isolated in an experimental cubicle overheard over a microphone what appeared to be an epileptic seizure by a fellow subject located in a nearby cubicle. Subjects were led to believe either that they alone had heard the emergency or that one or four unseen others in other cubicles were also listening in. Subjects were led to believe that there was no way of determining what any of the other witnesses were doing, nor of discussing the crisis and what steps to take about it with one's fellow subjects. On the basis of some hypotheses about the link between group size and the likelihood that any given individual would feel compelled to engage in helping behavior, Darley and Latane conjectured:

Hypothesis 1: the more bystanders to an emergency the less likely any one bystander will intervene to provide aid.

Darley and Latane ran this experiment with students in an introductory psychology course in groups of one, three, and five. As conjectured, the larger the group size, the less was the likelihood of any individual engaging in helping behavior ($\chi^2 = 7.91$, $p < .02$). No statistically significant difference in probability or speed of response were found between male and female students, nor did the sex of the victim give rise to a statistically significant difference in helping behavior. The basic data from this experiment are shown in Table 1, along with predictions derived from two models—one model advanced as a null hypothesis by Darley and Latane and the other model proposed by us.

By the end of the mock seizure, which lasted 125 seconds, 85 percent of the subjects who thought they alone knew of the victim's plight had reported the seizure while only 62 percent of those who thought one other bystander was present had done so. Only 31 percent of those who thought four other bystanders were present had done so. Within six minutes, after which time the experiment was halted, 100 percent of the subjects who thought themselves alone had reported the seizure, but only 82 percent of the subjects who thought one bystander was present had done so, and only 62 percent of the subjects who thought four others present had done so. However, virtually all responses came in the first three minutes. It is unlikely that allowing more time to elapse would have led to more acts of helping behavior. We should also note that the larger the group the slower the mean response time even of those subjects who did act. For groups of 1, 2, 5, mean response time for helping subjects were 52, 59, and 90 seconds, respectively. We shall not attempt to deal further with speed of response in this paper, but hope to do so elsewhere. However, we note that the cumulative distribution of helping responses in this experiment appears to fit a logarithmic model.

Darley and Latane contrast these data with those predicted from a simple binomial independent trials model which they use as null hypothesis. According to that model, there would be an interaction effect with group size and x_N, the probability of any given individual engaging in helping behavior before the fit had ended, should remain constant. This model implies that the probability that at least one member would engage in helping behavior in a group, each of whose members had identical response probabilities, of size N is simply one minus the probability that no member of the group would engage in helping behavior. That is, $1 - y_N = 1 - (1 - y_1)^N$, where

TABLE 1

EFFECTS OF GROUP SIZE ON LIKELIHOOD OF HELPING RESPONSE IN NONINTERACTIVE SITUATIONS AMONG STRANGERS: BYSTANDER RESPONSE TO A PURPORTED SEIZURE*

Group Size (N)	x_N** Probability of helping behavior by any given individual by end of fit: actual	null hypothesis	predicted	y_N† % of simulated groups in which there would be an act of helping behavior by end of fit: actual	null hypothesis	predicted	Number of Cases
1	.85	.85	.85	.85	.85	.85	13
2	.62	.85	.61	.86	.98	.85	26
5	.31	.85	.32	.84	.99+	.85	13

* Derived from Darley and Latane (1968).

** The null hypothesis is a simple independent trials model: $1 - x_N = 1 - x_1$. Predictions are based on the formula $1 - x_N = \exp[\log_e(1 - x_1)/N]$, where x_1 is obtained from row 1 as .85.

† The null hypothesis is a simple independent trials model: $1 - y_N = (1 - x_1)^N$. Predictions are based on the formula $1 - y_N = 1 - y_1$.

y_N is the proportion of groups in which at least one individual engages in helping behavior. It is easy to see that, regardless of the initial value of y_1, the $\lim[1 - (1 - y_1)^N] = 1$, since the value of $(1 - y_1)^N$ approaches 0 as N approaches infinity for $0 < y_1 < 1$. Of course, the data shown in Table 1 strongly contradict this null hypothesis model.

We see from the x_N values in Table 1 that in a noninteractive situation among strangers an individual subject is less likely to respond if he thinks that others are also in a position to respond.

> But what of the victim? Is the inhibition of the response of each individual strong enough to counteract the fact that with five onlookers there are five times as many people available to help? From the data of this experiment, it is possible mathematically to create hypothetical groups with one, two, or five observers. (Darley & Latane, 1968, p. 380.)

Darley and Latane go on to point out that the victim "is about equally likely to get help from one bystander as from two," i.e., $y_2 \cong y_1$. However, they appear blinded by variations in speed of response as a function of group size to the rather startling fact that $y_5 \cong y_1$, also. Sweeney (1973) also calls attention to this point. In other words, in a given time period individual subjects reduce their probability of helping behavior thus the probability of the victim being helped remains constant, given the further supposition that the other $N - 1$ subjects would reduce their response probabilities in the same way.

The percentage of groups in which there is an act of helping behavior is given by the formula $1 - y_N = (1 - x_N)^N$ since the proportion of groups in which there is no helping behavior is the same as the probability that no one within a given group will engage in helping behavior. But the data show y_N to be constant. Hence, since $y_1 = x_1$ we have $1 - x_1 = (1 - x_N)^N$. Taking logarithms on both sides, we have $\log_e (1 - x_1) = N \log_e (1 - x_N)$. Thus, $\log_e (1 - x_N) = \log_e (1 - x_1)/N$, and therefore, $1 - x_N = \exp [\log_e (1 - x_1)/N]$. This model is used in Table 1 to predict x_N values, given that $x_1 = .85$. As can be seen from column 4 of Table 1, the fit is amazingly good. If we look at data for the full six minute time period we find a good fit there too. For individual subjects ($N = 1$) the actual data indicate a certainty of response (1.00). For $N = 2$ and $N = 5$, the percentage of simulated groups in which there would be an act of helping behavior are .96 and .99, respectively. Thus, the hypothesis of constant y_N is well supported. However, given the paucity of data points and the use of aggregated data, we must be cautious in making too much of these results.

Nonetheless, it is interesting to apply this constant probability of group effort model to the circumstance of the Kitty Genovese case. If each of the witnesses to the Genovese murder assumed there to be 37 others witnessing the crime and if each behaved in accord with the formula $(1 - x_N)^N = 1 - x_1$, then each would engage in helping behavior with a probability of only .05 if $x_1 = .85$. Thus, if we assume that the Genovese case had a 15 percent probability of going unreported, the likelihood that any given witness would report the crime is only one in 20. If some witnesses to the murder assumed there to be more than 37 other bystanders, then the probability of these individuals engaging in helping action declines even further. We need not assume that the witnesses to the Genovese murder were alienated, apathetic, dehumanized or depersonalized in order to account for their inaction. Extrapolating from the Darley and Latane results and our model, reasonably normal people like those who took part in the Darley and Latane experiments would have also behaved with what would appear to be callousness and indifference.

Darley and Latane have run several other experiments in which they vary group size—in two cases using groups of two, and in one case a group of three. In each of these experiments, however, there are only two group sizes, and other factors vary across experiments making comparability with the data in Table 1 difficult.

Data reported in Table 2a are from an experiment in which subjects, strangers, who could see and talk to each other were exposed to voluminous smoke and what seemed to be a fire (Latane & Darley, 1968). Data reported in Table 2b are from an experiment in which subjects, again strangers, who could see and talk to each other, overheard an accident in an adjoining room in which a woman climbing on a chair to reach for a stack of papers appeared to have the chair collapse under her and in which they heard a scream followed by "Oh, my God, my foot . . . I can't move . . . it. Oh . . . my ankle . . . I can't get this thing . . . off me." (Latane & Rodin, 1969). In these experiments, unlike the earlier one, communication among subjects was possible.

As can be seen from Table 2, once again the probability of helping behavior declined with group size. Moreover, in both experiments at most one subject in any group ever engaged in helping behavior. Hence, in the smoke experiment for $N = 3$ there was only a .13 probability that a subject would engage in helping behavior, as contrasted with a .75 probability of such helping for single subjects, and in the lady in distress experiment for $N = 2$ there was only a .20 probability that a subject would engage in helping behavior, as contrasted with a .70 probability of helping for single individuals. Even if we compensate mathematically for this seeming closure effect, as we do in column 2 of Table 2, the probability of helping behavior still declines rapidly with N—in the smoke experiment for $N = 3$, $x_3 = .15$, and in the lady in distress experiment for $N = 2$, $x_2 = .33$. By the closure effect we mean the phenomenon in interacting groups of the first helping response by any individual in the group inhibiting any acts of helping by other group members. Moreover, in these two interactive situations x_N declines far more rapidly with N than it did in the non-interactive experimental situation reported in Table 1. In the null hypothesis, y_N should actually increase with N. In the earlier experiment, the decline in x_N was only sufficient so as to prevent y_N from increasing with N, i.e., y_N remained constant. In these two experiments the decline in x_N is so large as to cause y_N to decrease sharply with increasing N. In fact, the decline in y_N is so sharp as to lead us to suggest an inverse square model, i.e., we have hypothesized that $(1 - y_N)^N = 1 - y_1$, and hence, since $(1 - x_N)^N = 1 - y_N$, it will follow that $1 - x_N = (1 - y_1)^{-N_2}$. In short, strangers in an interactive situation considerably inhibit each other's response probabilities. The fit of this model to the data is shown in column 5 of Table 2. This fit is good, though far from perfect. Given the ridiculously few data points, two, the aggregated nature of

TABLE 2

EFFECTS OF GROUP SIZE ON LIKELIHOOD OF HELPING RESPONSE IN INTERACTIVE SITUATIONS AMONG STRANGERS

	Group size (N)	x_N† Estimated probability of helping behavior by any given individual if no closure effect	y_N‡ % of groups in which there was an act of helping behavior: actual	null hypothesis	predicted	Number of cases
2a:	1	.75	.75	.75	.75	24
Smoke experiment*	3	.15	.38	.98	.37	8
2b:	1	.70	.70	.70	.70	26
Lady in distress**	2	.33	.40	.97	.46	20

* Derived from Latane and Darley (1968).

** Derived from Latane and Rodin (1969).

† Estimated using the formula $1 - x_N = \exp[\log_e(1 - y_N)/N]$.

‡ The null hypothesis is a simple independent trials model: $y_N = (1 - y_1)^N$. Predictions are based on the formula $1 - y_N = \exp[\log_e(1 - y_1)/N]$.

TABLE 3

EFFECTS OF GROUP SIZE ON LIKELIHOOD OF HELPING RESPONSE IN INTERACTIVE SITUATIONS AMONG FRIENDS: LADY IN DISTRESS*

Group size (N)	x_N** Estimated probability of helping behavior by any given individual if no closure effect	y_N† % of groups in which there was an act of helping behavior			Number of cases
		actual	null hypothesis	predicted	
1	.70	.70	.70	.70	26
2	.45	.70	.91	.70	20

* Derived from Latane and Rodin (1969).

** Estimated using the formula $1 - x_N = \exp[\log_e(1 - x_1)/N]$.

† The null hypothesis is a simple independent trials model: $1 - y_N = (1 - y_1)^N$. Predictions are based on the formula $1 - y_N = 1 - y_1$.

the data, and the absence of any convincing theoretical rationale for the model, we offer the inverse square model as only suggestive, and we believe that a more useful line of approach is in the direction of stochastic models of inhibition and contagion such as those generated by Coleman (1964) to deal with similar problem areas. Available data provide too few data points to test such models.

The next investigation we shall consider is identical to that reported in Table 2b except that the subjects in the groups of two were friends rather than strangers. The data are given in Table 3. We see that friends do not behave as strangers but as if they were one, i.e., two friends in an interactive situation respond with the same response as that of a single individual. This result suggests the applicability to this data of the constant product model originally inspired by data in Table 1. This we do in Table 3. Friends appear to "coordinate" helping activities. Latane and Rodin (1969) find that communication about possible responses to the crisis was considerably more likely among friendship pairs than among pairs of strangers, but the data are not disaggregated for groups which did and did not communicate.

The final investigation we shall consider involves a natural setting, a discount beer store which was robbed 96 times of a case of beer in the presence of other customers and the absence of the checkout clerk.

> The robberies were always staged when there were either one or two people in the store, and the timing was arranged so that one or both customers would be at the checkout counter at the time when the robbers entered. Although occasionally the two customers had come in together, more usually they were strangers to each other. Since the checkout counter was about 20 feet from the front door, since the theft itself took less than a minute, and since the robbers were both husky young men, nobody tried directly to prevent the theft.
>
> When the cashier returned from the rear of the store, he went to the checkout counter and resumed waiting on the customers there. After a minute, if nobody had spontaneously mentioned the theft, he casually inquired, "Hey, what happened to that man (those men) who was (were) in here? Did you see him (them) leave?" At this point the customer could either report the theft, say merely that he had seen the man or men leave, or disclaim any knowledge of the event whatsoever. (Latane & Darley, 1969a, p. 259).

In this experiment we once again had an interactive situation—this time, however, some dyads consisted of friends and some of strangers. As might be hoped, the mean response probabilities for the dyads were intermediate between that predicted by the model developed for interactive friends, the constant product model, and that predicted by the model developed for interactive strangers, the inverse square model. The basic data from this experiment are presented in Table 4. Unfortunately, Latane and Darley do not disaggregate the data into that for groups of friends and that for groups of strangers.

CONCLUSIONS

While popular wisdom has it that there is safety in numbers, the experiments reported above and the models from which we have extrapolated them cast grave doubt on the truth of this folk wisdom. The fewer the visible witnesses present, the more likely is the victim to get help or an emergency to be reported. At best, groups of bystanders are only as likely as single bystanders to engage in helping behavior; never are they more likely to do so. Moreover, when a bystander is in a situation in which his fellow bystanders are strangers to him and in which the lack of response by his fellow

TABLE 4

EFFECTS OF GROUP SIZE ON LIKELIHOOD OF COMBINED SPONTANEOUS AND NONSPONTANEOUS HELPING RESPONSE IN INTERACTIVE SITUATIONS AMONG MIXED GROUPS OF FRIENDS AND STRANGERS: THE CASE OF THE STOLEN BEER*

Group size (N)	x_N** Estimated probability of helping behavior, both spontaneous and nonspontaneous, by any given individual if no closure effect		y_N† % of groups in which there was a spontaneous or nonspontaneous act of helping behavior. actual	null hypothesis	predicted		Number of cases
					Fr.	*Str.*	
1	.67		.67	.67	.67	.67	46
	if friends	if strangers					
2	.43	.34	.56	.87	.43	.67	46

* Derived from Latane and Darley (1969a).

** Values for groups of friends are simulated using the formula $1 - x_N = \exp[\log_e (1 - x_1)/N]$. Values for groups of strangers are simulated using the formula $1 - x_N = \exp[\log_e (1 - y_N)/N]$.

† The null hypothesis is a simple independent trials model: $1 - y_N = (1 - y_1)$. Predictions for groups of all strangers are based on the formula $1 - y_N = \exp[\log_e (1 - y_1)/N]$. Predictions for groups of all friends are based on the formula $1 - y_N = 1 - y_1$.

bystanders is visible to him, his probability of intervention seems to be inhibited more than when he does not know what other bystanders are doing. Latane and Darley (1968, pp. 220–221) have suggested that the presence of (a) nonintervening other(s) diminishes the likelihood that a subject defines the situation as one requiring his assistance. However, when communication among bystanders is possible, friends, unlike strangers, appear to coordinate efforts.

Darley and Latane regard their main point, that group size makes a difference, as established and are not aware of the striking fit their data provide for a constant output model. They appear not to have run further experiments involving major variations in group size. Instead, they and other experimentors have turned to other variables, e.g., communication possibilities among bystanders, type of crisis, etc. In this they are consistent with a common practice among social psychologists. Having found that a treatment effect either does or does not give rise to a statistically significant difference in some behavior(s), they do not go on to learn how much of a difference there is or to try to develop a theory with which to predict not only the direction but also the magnitude of the effect. We might also note that Darley and Latane (1968, p. 383) found no connection between personality variables such as alienation, machiavellianism, need for approval, or authoritarianism and probability, or speed of helping response. Thus, unfortunately, we have far too few data points from existing experimental data to conclude much of anything about the exponential models proposed in this paper, and we offer them as suggestive only.

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